

to the total [propagating power] optical power propagating through said optical fiber is set to not more than 1%.

9. (Amended) An optical fiber according to claim 3, wherein said optical fiber is operated in a single mode at a given wavelength between 1510nm to 1590nm.

10. (amended) An optical fiber according to claim 3, wherein the chromatic dispersion at a given wavelength between 1510nm and 1590 nm is set to a value below - 80 ps/nm/km.

REMARKS

Claims 1-15 are active and pending in the present application, all of which stand rejected. In addition, the Examiner has objected to a number of informalities within the specification and figures. In response, Applicant has amended claims 1, 8, 9 and 10, amended various portions of the specification, and proposed amendments to figures 16 and 22. Great care has been exercised to avoid introducing new subject matter into the present application.

Figures 16 and 22 are objected to for not including a legend such as "Prior Art". In response, Applicants are submitting herewith a request for drawing amendment adding the "Prior Art" legend to each of figure 16 and figure 22. Reconsideration and withdrawal of the objection are respectfully requested.

The figures are objected to for not showing "the optical path including an optical fiber with a positive chromatic dispersion" as recited in claim 11. Applicants urge that

FIG. 21 shows a transmission path including an optical fiber 83 having a positive chromatic dispersion and an optical fiber 84 having a negative chromatic dispersion and, thus, illustrates the features recited in claim 11. Reconsideration and withdrawal of the objection are respectfully requested.

The Examiner asserts that the title of the invention is not descriptive. In response, Applicants have amended the title to read "Microstructured Optical Fiber". Applicants urge that the amended title is clearly indicative of the invention to which the claims are directed and request withdrawal of the objection.

Applicants thank the Examiner for identifying a number of informalities within the specification. The present amendment corrects a number of these informalities as directed by the Examiner. However, Applicants urge that a number of the objections do not require correction:

Page 5, line 11: Applicants urge that one of ordinary skill would have no difficulty understanding "Ge" as referring to Germanium and, therefore, does not require any further explanation.

Page 7, line 12: As described in the specification at page 27, lines 13-15, the relative refractive index difference Δ of medium A to medium B is given by

$\Delta = (n_A^2 - n_B^2) / (n_A^2 + n_B^2)$, where n_A and n_B are the refractive indices of mediums A and B, respectively. In the present case $(n_{core}^2 - n_{outer}^2) / (n_{core}^2 + n_{outer}^2) \geq 2\%$ (or 0.02), where n_{core} and n_{outer} are the mean refractive indices of the core region and the outer cladding region, respectively. Applicants urge that 2%, without further explanation, is how one of ordinary skill would describe the disclosed relative refractive index

difference. Accordingly, reconsideration and withdrawal of the objection to "2%" are respectfully requested.

Similar to the explanation above, the "-0.1%" at page 7, line 21 does not need any additional clarification as it properly and fully describes this other relative refractive index difference as being less than or equal to -0.001 where medium A is the first inner cladding region and medium B is the second inner cladding region. Accordingly, reconsideration and withdrawal of the objection to "-0.1%" are respectfully requested.

In the mathematical formula at page 2, lines 9-11, the form of the inequality is (expression A) (relationship symbol B) (expression C) (relationship symbol D) (expression E). It is convention that "left-hand side" refers to (expression A) and "right-hand side" refers to (expression E). Thus, "both side members" of equation (1) would be understood by one of ordinary skill as referring to $(f_1 n_1^2 + f_2 n_2^2)$ and

$$\left(\frac{f_1}{n_1^2} + \frac{f_2}{n_2^2} \right)^{(-)}$$

Accordingly reconsideration and withdrawal of the objection is requested.

The Examiner asks for an explanation of four-fold rotational symmetry as described at page 6, lines 23-25. When an object does not change between before and after an operation to rotate the object by a certain angle less than 360 degrees, the object has rotational symmetry. Particularly, when an object does not change between before and after an operation to rotate the object by $360/N$ degrees, the object has N-fold rotational symmetry. Applicants have provided two references in an appendix attached hereto that illustrate such terminology is quite common in the art and would be easily understood by one of ordinary skill. Reconsideration and withdrawal of this objection are requested.

The Examiner objects to page 7, lines 10-17 which includes the phrase "relatively low". One formula for the relative refractive index difference Δ was provided above; that relation is equivalent to $n_{\text{outer}}^2 \leq (1 - 2 * 0.02)n_{\text{core}}^2$. When looking at the relation in this form, it becomes clear that the mean refractive index of the outer cladding region is low relative to that of the core region as described in the specification on page 7.

Reconsideration and withdrawal of this objection are respectfully requested.

Claim 8 stands rejected under the first paragraph of 35 USC 112 for reciting a particular ratio between the power through the sub medium of the outer cladding and total power. Optical fibers having voids such as those disclosed, for example, in US 5,802,336 are called optical fibers having microstructure in the present specification.

Microstructure refers to the regions made of sub mediums, and voids are instances of sub mediums. Such terminology is also used in the prior art such as 5,802,236 at column 2, lines 64-66. Accordingly, one skilled in the art would recognize that the ratio, at page 8 lines 1-4, of the "power propagating through the microstructures of the outer cladding" to the "total propagating power" is equivalent to the ratio as recited in claim 8.

Accordingly, Applicants urge that the specification describes the subject matter of claim 8 in such a way as to enable one skilled in the art to make and/or use the invention.

Reconsideration and withdrawal of the rejection under 35 USC 112, 1¶ of claim 8 are respectfully requested.

Claims 6-10 stand rejected under the second paragraph of 35 USC 112 as being indefinite. The Examiner asserts that the recitation of "%" in claims 6 and 7 is unclear as it does not specify % of what. Applicants have provided an explanation above, with respect to analogous objections to the specification, regarding the meaning of, and the

conventional way of specifying, relative refractive index difference Δ of medium A to medium B. As explained, and readily recognized by one skilled in the art, "2%" is equivalent to 0.02 and "-0.1%" is equivalent to -0.001 when describing each relative refractive index difference. Thus, one of ordinary skill when interpreting claims 6 and 7 in light of the specification would be reasonably certain of their scope thereby satisfying the requirements of the second paragraph of 35 USC 112. Applicants request reconsideration and withdrawal of the rejection under 35 USC 112 of claims 6 and 7.

The Examiner asserts claim 8 is indefinite for not specifying whether the total propagating power is through the fiber or the outer cladding. Accordingly, Applicants have amended claim 8 to recite "total optical power propagating through said optical fiber." So that the claims remain consistent with the specification, Applicants have amended the specification to reflect the amended claim language. Reconsideration and withdrawal of the rejection under 35 USC 112, second paragraph, of claim 8 are respectfully requested.

The Examiner asserts that claims 9 and 10 are indefinite for reciting chromatic dispersion without specifying a wavelength value. Accordingly, Applicants have amended claims 9 and 10 to specify "a given wavelength between 1510nm to 1590nm". This range of wavelengths is supported in the original specification, for example, at FIG. 19.

Claims 1, 2 and 12-14 stand rejected under 35 USC 102(b) as anticipated by DiGiovanni et al. (5,802,236). The Examiner asserts that the '236 patent identically discloses every feature recited in claims 1, 2 and 12-14.

The '236 patent discloses that the effective refractive index of a cladding region can be adjusted by adjusting the sub medium region, and that a large negative dispersion can be realized by an effective index profile in which the effective index decreases in the order of the core region, the outer cladding region, and the inner cladding region. However, the '236 patent does not disclose or suggest that such a structure has a number of problems such as a small effective core area, high bending loss, and high sensitivity of the effective core area to the fluctuation of structural parameters. Without recognizing these problems, the '236 patent does not disclose that resolution of these problems can be accomplished by providing at least at least three cladding regions having different mean refractive indices from the adjacent regions, at least one of them having a lower mean refractive index than the adjacent regions, and at least one of them having sub medium regions, as recited in amended claim 1. Thus, Applicants urge that the '236 patent does not identically disclose every feature recited by claim 1, as amended, and does not factually support the rejection under 35 USC 102. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 USC 102 of claim 1 and its dependent claims 2 and 12-14.

Independent of the above argument, claim 2 recites additional features not disclosed by the '236 patent. The structure of the '236 patent includes a plurality of cladding, some of which are made of homogenous medium and the refractive index of the core region is greater than that of the cladding regions. However, the '236 patent does not appreciate nor disclose that it is possible to realize the desired optical properties more easily than in the conventional microstructured fibers and to realize a lower bending loss than in the conventional impurity-doped optical fibers by adopting an outer cladding

region that surrounds the (homogenous) inner cladding region and is provided with sub medium regions as recited in claim 2. Thus, Applicants urge that the '236 patent does not identically disclose every feature recited by claim 2 and does not factually support the rejection under 35 USC 102. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 USC 102 of claim 2.

Claims 3-11 and 15 stand rejected under 35 USC 103 over DiGiovanni ('236). The Examiner asserts that the specific values recited in the dependent claims are "within the general skill of a worker in the art to select a known material and operating parameters on the basis of its suitability for the intended use." As these dependent claims incorporate all the features of claim 1, Applicants urge that claims 3-11 and 15 are not obvious in view of the '236 patent for at least the reasons presented above with respect to claim 1. Additionally, Applicants urge that the Examiner has not properly discharged the initial burden of providing a cogent explanation of why one of ordinary skill would have been motivated to extrapolate the teachings of the '236 patent to arrive at the invention recited in claims 3-11 and 15. The Examiner contends that a skilled artisan could have selected material to match the features of the claims; however, except within the present claims and specification, no explanation has been provided as to why the skilled artisan would have been motivated to make such selections. Applicants respectfully urge that a *prima facie* case of obviousness under 35 USC 103, with respect to claims 3-11 and 15, has not been properly established and request reconsideration and withdrawal of the rejection of claims 3-11 and 15.

For example, claim 15 recites a particular relationship of mean refractive indices of cladding regions (e.g., n_1 , n_2 , n_3) and a core region (e.g., n_0). The '236 patent does not

appreciate, and does not disclose or suggest, that a large effective core area with a large negative dispersion and a large negative dispersion slope can be realized in a structure having a three-layer cladding region. Wherein, specifically, the particular three-layer structure recited in the claim includes 3 cladding regions (first inner, second inner and outer) and where the relationship $n_0 > n_2 > n_1$ and $n_2 > n_3$ holds. Applicants urge that the mere possibility that a skilled artisan could select materials with different refractive indices does not provide a cogent explanation of why one would be motivated to arrange the materials into a three-layer cladding structure in such a manner as to satisfy the relationship recited in claim 15.

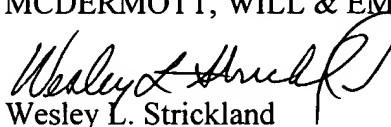
SUMMARY

In view of the above remarks and amendments, Applicants believe claims 1-15 are in condition for allowance and passage of this case to issue is respectfully requested.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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